

Appendix H – KOCH Membrane Specifications

FLUID SYSTEMS TFC® - ULP 4"

Ultra-Low Pressure, RO Elements



PRODUCT DESCRIPTION

Membrane Chemistry:	Proprietary TFC® polyamide
Membrane Type:	TFC®-ULP
Construction:	Spiral-wound with fiberglass outerwrap
Applications:	Ultra-low pressure application for light industrial & potable water production

SPECIFICATIONS

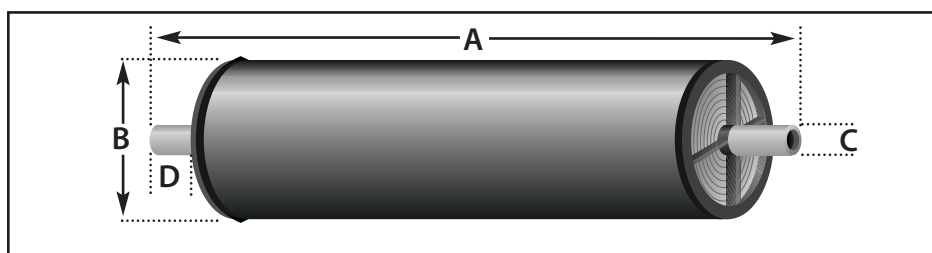
Model	Permeate Flow		Chloride Rejection	Membrane Area	
	gpd	(m³/d)		ft²	(m²)
TFC® 4820 ULP	1,750	(6.6)	98.5	78	(7.2)

Test Conditions: 2,000 mg/l NaCl solution at 125 psi (860 kPa) applied pressure, 15% recovery, 77°F (25°C) and pH 7.5.

OPERATING & DESIGN INFORMATION

Typical operating pressure:	50 - 175 psi (345 - 1,200 kPa)
Maximum operating pressure:	350 psi (2,400 kPa)
Maximum operating temperature:	113°F (45°C)
Maximum cleaning temperature:	113°F (45°C)
Maximum continuous free chlorine:	<0.1 mg/l
Allowable pH - continuous operation:	4 - 11
Allowable pH - short term cleaning:	2.5 - 11
Maximum differential pressure per element:	10 psi (69 kPa)
Maximum differential pressure per vessel:	60 psi (414 kPa)
Maximum feed turbidity:	1 NTU
Maximum feed SDI (15 minute):	5
Feed spacer thickness:	31 mil (0.8 mm)

PRODUCT DIMENSIONS AND WEIGHT



Model	A	B	C	D	Weight	Part Numbers		
	inches (mm)	inches (mm)	inches (mm)	inches (mm)		Interconnector	O-ring	Brine Seal
TFC® 4820 ULP	40 (1,016)	4 (101.6)	0.75 (19.0)	1.0 (25.4)	10 (4.5)	0035267	0035458	0035702

TFC® - ULP 4"

Performance:

Performance specifications shown on the front side of this document are nominal values. Individual element permeate flows may vary +20/-15% from the values shown. Minimum chloride ion rejection is 97.5% at the conditions shown.

System performance should be predicted using KMS' ROPRO® design software. Element performance within ROPRO® is based on the nominal values shown.

System operating data should be normalized and key performance parameters tracked using KMS' NORMPRO® software.

Operating Limits:

- **Operating Pressure:** Maximum operating pressure is 350 psi (2,400 kPa). Typical operating pressure for TFC®-ULP systems is in the range of 50 psi (345 kPa) to 175 psi (1,200 kPa). Actual operating pressure is dependent upon system flux rate (appropriate for feed source) as well as feed salinity, recovery and temperature conditions.
- **Permeate Pressure:** Permeate pressure should not exceed feed-concentrate pressure by more than 5 psi (34 kPa) at any time (on-line, off-line and during transition).
- **Differential Pressure:** Maximum differential pressure is 10 psi (69 kPa) for a 40" (1,016 mm) long element. Maximum differential pressure for any length pressure vessel is 60 psi (414 kPa).
- **Temperature:** Maximum operating temperature is 113°F (45°C). Maximum cleaning temperature is 113°F (45°C).
- **pH:** Allowable range for continuous operation is pH 4 - 11. Allowable range for short term cleaning is pH 2.5 - 11.
- **Turbidity and SDI:** Maximum feed turbidity is 1 NTU. Maximum feed Silt Density Index (SDI) is 5.0 (15 minute test). Experience has shown that feedwater with turbidity greater than 0.2 NTU generally results in excessive cleanings.
- **Recovery:** Maximum recovery is site and application specific. In general, single element recovery is approximately 15%. Recovery limits should be determined using KMS' ROPRO® program.

Chemical Tolerance:

- **Chlorine:** Intentional exposure of TFC®-ULP membrane to free chlorine or other oxidizing agents such as permanganate, ozone, bromine and iodine is not recommended. TFC®-ULP membrane has a free chlorine tolerance of approximately 1,000 ppm-hours based on testing at 77°F (25°C), pH 8. This tolerance may be significantly reduced if catalyzing metals such as iron are present or if the pH and/or temperature are different. Sodium metabisulfite (without catalysts such as cobalt) is the preferred reducing agent. TFC®-ULP membrane has a chloramine tolerance of approximately 60,000 ppm-hours in the absence of free chlorine based on testing at 77°F (25°C), pH 8.
- **Cationic (Positively Charged) Polymers and Surfactants:** TFC®-ULP membrane may be irreversibly fouled if exposed to cationic (positively charged) polymers or surfactants. Exposure to these chemicals during operation or cleaning is not recommended.

Lubricants:

For element loading, use only the supplied silicone lubricant (or approved equivalent), water or glycerin to lubricate O-rings and brine seals. The use of petroleum based lubricants or vegetable based oils may damage the element and void the warranty.

Service and Ongoing Technical Support:

KMS has an experienced staff of professionals available to assist endusers and OEM's for optimization of existing systems and support with the development of new applications. Along with the availability of supplemental technical bulletins, KMS also offers a complete line of KochTREAT™ and KochKLEEN® RO pretreatment and maintenance chemicals.

FLUID SYSTEMS TFC® - HR 4"

High Rejection, Low Pressure, Brackish Water, RO Element



PRODUCT DESCRIPTION

Membrane Chemistry: Proprietary TFC® polyamide
 Membrane Type: TFC-HR®
 Construction: Spiral-wound with fiberglass outerwrap
 Applications: High rejection for brackish water treatment

SPECIFICATIONS

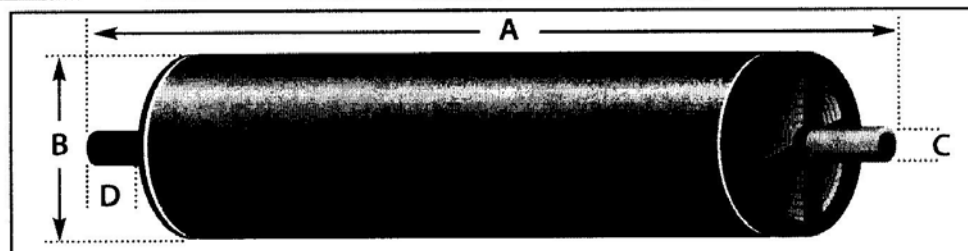
Model	Permeate Flow		Chloride Rejection	Membrane Area	
	gpd	(m³/d)		ft²	(m²)
TFC® 4820 HR	2,100	(7.9)	99.5	78	(7.2)

Test Conditions: 2,000 mg/l NaCl solution at 225 psi (1,550 kPa) applied pressure, 15% recovery, 77°F (25°C) and pH 7.5.

OPERATING & DESIGN INFORMATION

Typical operating pressure:	225 - 450 psi (1,550 - 3,100 kPa)
Maximum operating pressure:	600 psi (4,140 kPa)
Maximum operating temperature:	113°F (45°C)
Maximum cleaning temperature:	113°F (45°C)
Maximum continuous free chlorine:	<0.1 mg/l
Allowable pH - continuous operation:	4 - 11
Allowable pH - short term cleaning:	2.5 - 11
Maximum differential pressure per element:	10 psi (69 kPa)
Maximum differential pressure per vessel:	60 psi (414 kPa)
Maximum feed turbidity:	1 NTU
Maximum feed SDI (15 minute):	5
Feed spacer thickness :	31 mil (0.8 mm)

PRODUCT DIMENSIONS AND WEIGHT



Model	A	B	C	D	Weight	Part Numbers		
	inches (mm)	inches (mm)	inches (mm)	inches (mm)		Interconnector	O-ring	Brine Seal
TFC® 4820 HR	40 (1,016)	4 (101.6)	0.75 (19.0)	1.0 (25.4)	10(4.5)	0035267	0035458	0035702

TFC® - HR 4"

Performance:

Performance specifications shown on the front side of this document are nominal values. Individual element permeate flows may vary +20/-15% from the values shown. Minimum chloride ion rejection is 99.2% at the conditions shown.

System performance should be predicted using KMS' ROPRO® design software. Element performance within ROPRO® is based on the nominal values shown.

System operating data should be normalized and key performance parameters tracked using KMS' NORMPRO® software.

Operating Limits:

- **Operating Pressure:** Maximum operating pressure is 600 psi (4,140 kPa). Typical operating pressure for TFC®-HR systems is in the range of 225 psi (1,550 kPa) to 450 psi (3,100 kPa). Actual operating pressure is dependent upon system flux rate (appropriate for feed source) as well as feed salinity, recovery and temperature conditions.
- **Permeate Pressure:** Permeate pressure should not exceed feed-concentrate pressure by more than 5 psi (34 kPa) at any time (on-line, off-line and during transition).
- **Differential Pressure:** Maximum differential pressure is 10 psi (69 kPa) for a 40" (1,016 mm) long element. Maximum differential pressure for any length pressure vessel is 60 psi (414 kPa).
- **Temperature:** Maximum operating temperature is 113°F (45°C). Maximum cleaning temperature is 113°F (45°C).
- **pH:** Allowable range for continuous operation is pH 4 - 11. Allowable range for short term cleaning is pH 2.5 - 11.
- **Turbidity and SDI:** Maximum feed turbidity is 1 NTU. Maximum feed Silt Density Index (SDI) is 5.0 (15 minute test). Experience has shown that feedwater with turbidity greater than 0.2 NTU generally results in frequent cleanings.
- **Recovery:** Maximum recovery is site and application specific. In general, single element recovery is approximately 15%. Recovery limits should be determined using KMS' ROPRO® program.

Chemical Tolerance:

- **Chlorine:** Intentional exposure of TFC®-HR membrane to free chlorine or other oxidizing agents such as permanganate, ozone, bromine and iodine is not recommended. TFC®-HR membrane has a free chlorine tolerance of approximately 1,000 ppm-hours based on testing at 77°F (25°C), pH 8. This tolerance may be significantly reduced if catalyzing metals such as iron are present or if the pH and/or temperature are different. Sodium metabisulfite (without catalysts such as cobalt) is the preferred reducing agent. TFC®-HR membrane has a chloramine tolerance of approximately 60,000 ppm-hours in the absence of free chlorine based on testing at 77°F (25°C), pH 8.
- **Cationic (Positively Charged) Polymers and Surfactants:** TFC®-HR membrane may be irreversibly fouled if exposed to cationic (positively charged) polymers or surfactants. Exposure to these chemicals during operation or cleaning is not recommended.

Lubricants:

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Service and Ongoing Technical Support:

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